

# Underground Natural Gas Storage



**Kenneth Lee**

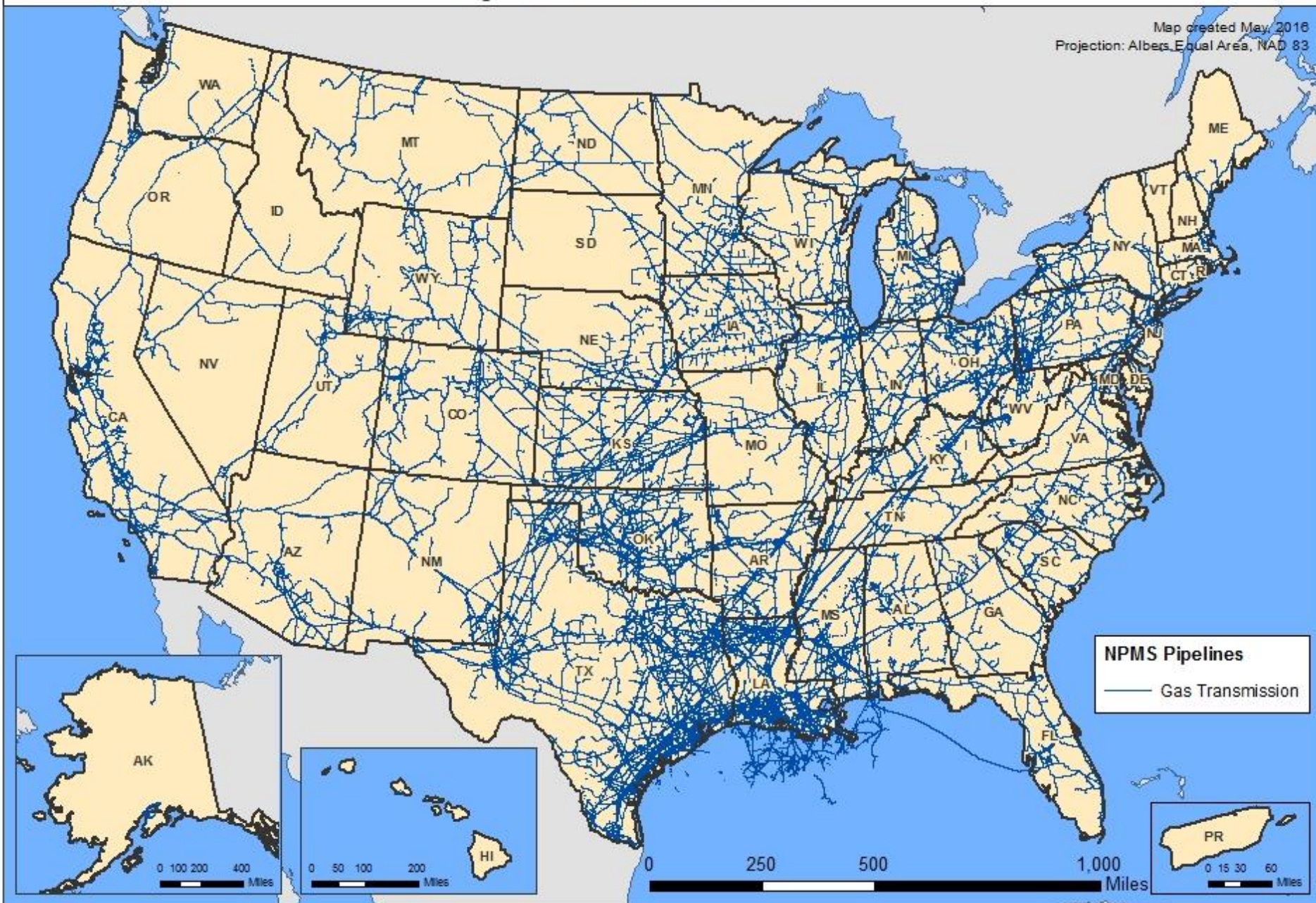
Director, Engineering & Research Division  
USDOT PHMSA Office of Pipeline Safety



# Gas Transmission Pipelines

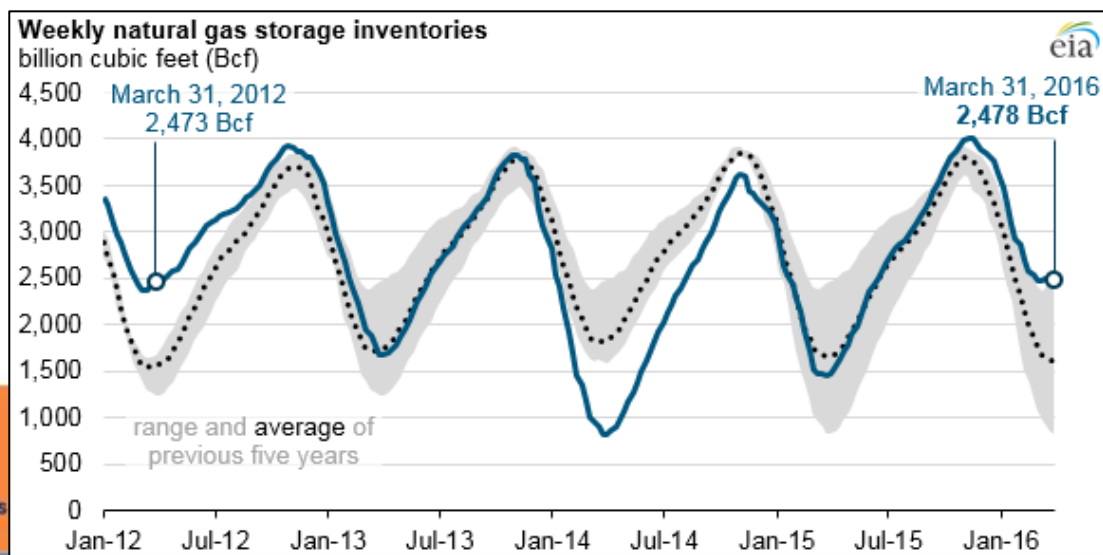
Pipeline data as of 05/12/2016

Map created May, 2016  
Projection: Albers Equal Area, NAD 83



# Natural Gas Pipeline Storage

- Natural gas transmission pipelines **do not** have capacity to meet peak demand (much larger pipelines would need to be built)
- Storage is needed to meet variable demand:
  - **Base Load**: Long-term(~months) seasonal increases
  - **Peak Load**: Short-term(hours-days-weeks) sudden increases



# Types of Natural Gas Pipeline Storage

**1) Liquefied Natural Gas (LNG)**

**2) Line Pack:** “Pack the pipeline full” by increasing the pressure (up to MAOP)

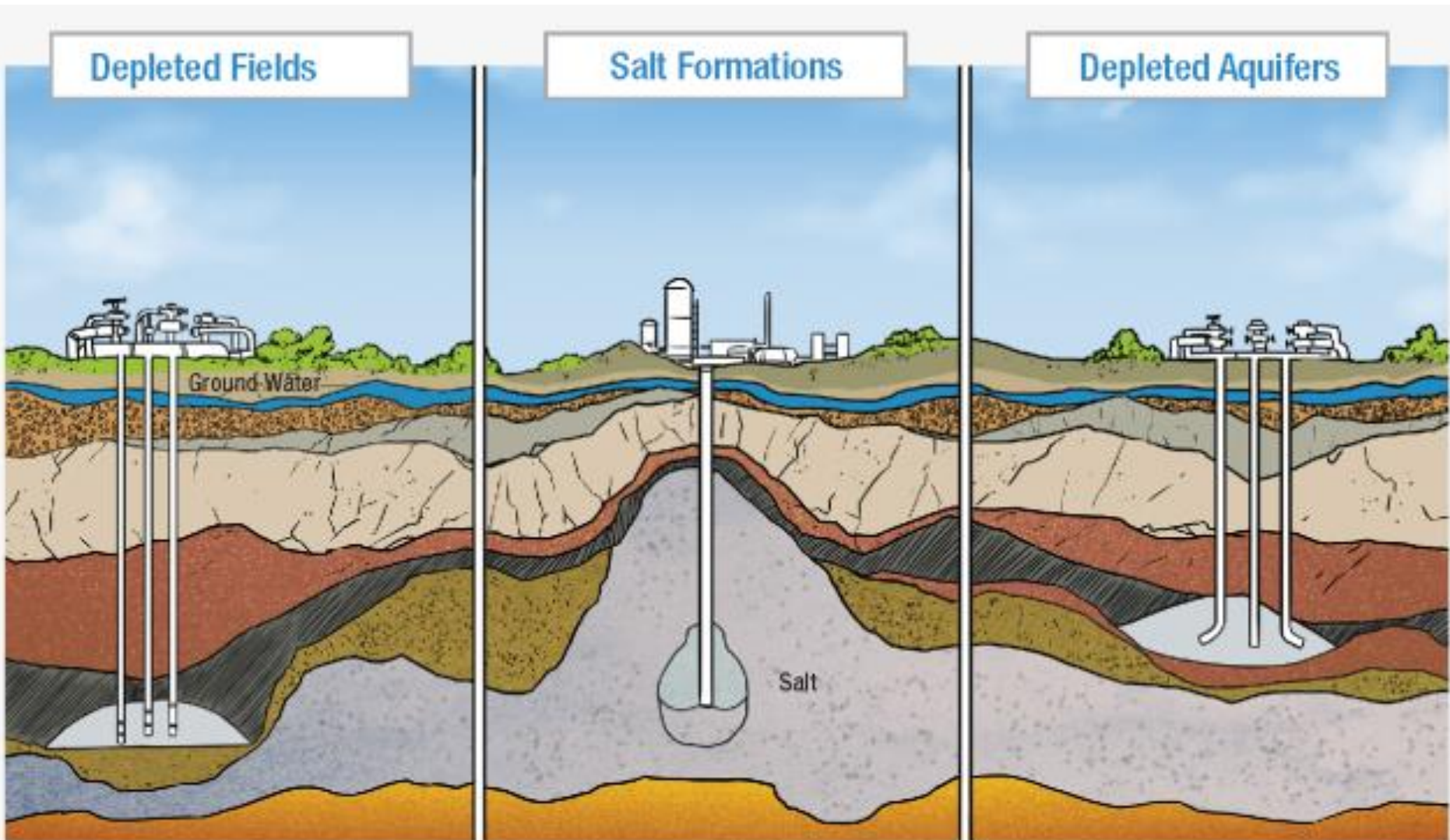
**3) Liquefied Petroleum Gas (e.g. Propane)**

**4) Underground Storage**

- Depleted Fields
- Depleted Aquifers
- Salt Caverns

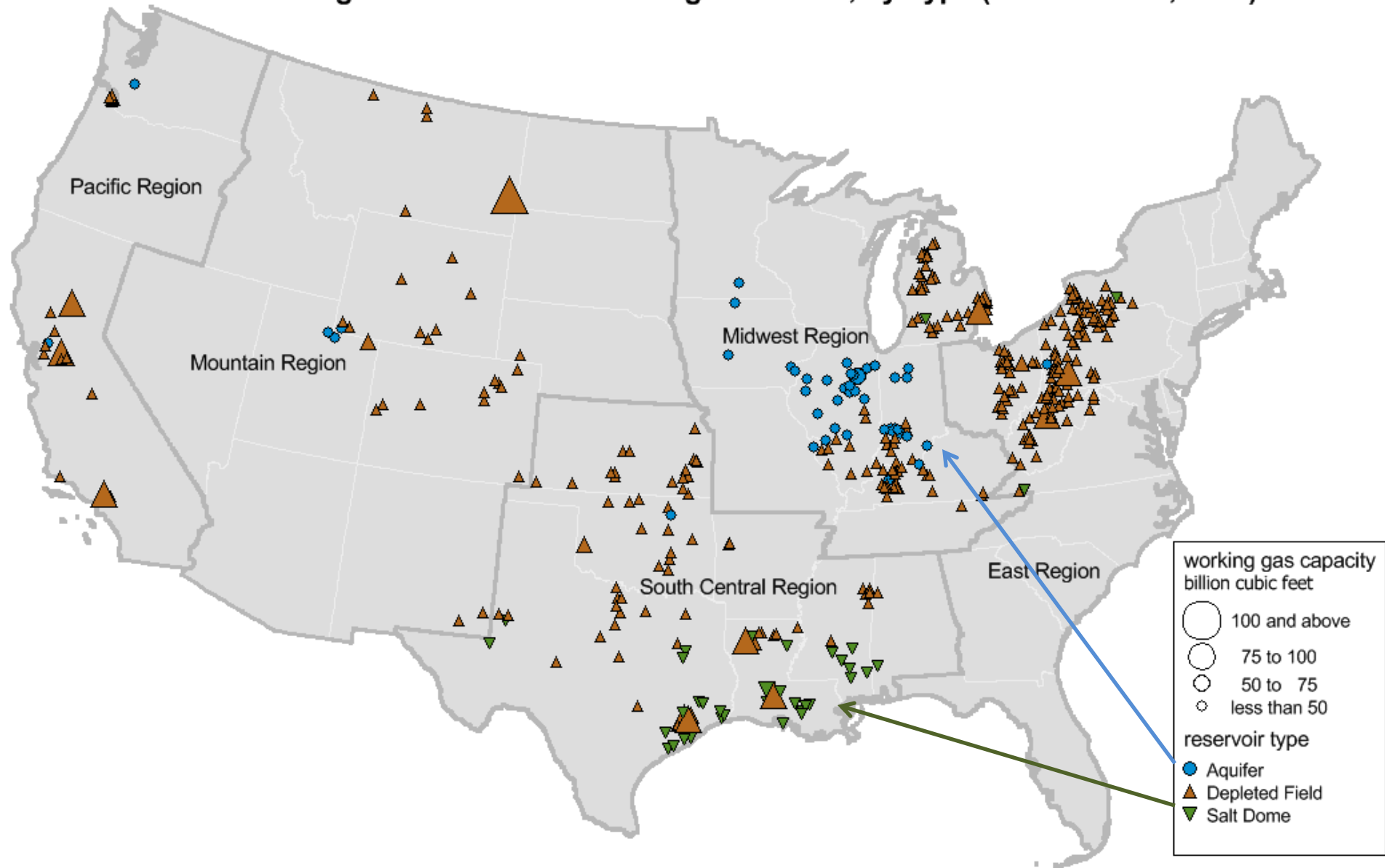


# 3 Types of Underground Storage



# ~400 Facility Locations (eia)

U.S. Underground Natural Gas Storage Facilities, by Type (December 31, 2015)



# Federal Safety Regulations

- **Natural Gas Pipeline Safety Act of 1968**

- The first federal statute regulating pipeline safety
- Authority for transportation of gas:
  - Non-rural gathering lines
  - Transmission lines
  - Distribution lines
  - Storage



## Public Law 90-481

August 12, 1968  
[S. 1166]

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Natural Gas  
Pipeline Safety  
Act of 1968.

## AN ACT

To authorize the Secretary of Transportation to prescribe safety standards for the transportation of natural and other gas by pipeline, and for other purposes.

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "Natural Gas Pipeline Safety Act of 1968".*

## DEFINITIONS

SEC. 2. As used in this Act—

(1) "Person" means any individual, firm, joint venture, partnership, corporation, association, State, municipality, cooperative association, or joint stock association, and includes any trustee, receiver, assignee, or personal representative thereof;

(2) "Gas" means natural gas, flammable gas, or gas which is toxic or corrosive;

(3) "Transportation of gas" means the gathering, transmission or distribution of gas by pipeline or its storage in or affecting interstate or foreign commerce; except that it shall not include the gathering of gas in those rural locations which lie outside the limits of any incorporated or unincorporated city, town, village, or any other designated residential or commercial area such as a subdivision, a business or shopping center, a community development, or any similar populated area which the Secretary may define as a nonrural area;

standards for pipeline facilities and the transportation of gas not subject to the jurisdiction of the Federal Power Commission under the Natural Gas Act as are not incompatible with the Federal minimum standards, but may not adopt or continue in force after the interim standards provided for above become effective any such standards applicable to interstate transmission facilities.

52 Stat. 821.  
15 USC 717w.

(b) Not later than twenty-four months after the enactment of this Act, and from time to time thereafter, the Secretary shall, by order, establish minimum Federal safety standards for the transportation of gas and pipeline facilities. Such standards may apply to the design, installation, inspection, testing, construction, extension, operation, replacement, and maintenance of pipeline facilities. Standards affecting the design, installation, construction, initial inspection, and initial testing shall not be applicable to pipeline facilities in existence on the date such standards are adopted. Whenever the Secretary shall find a particular facility to be hazardous to life or property, he shall be empowered to require the person operating such facility to take such steps necessary to remove such hazards. Such Federal safety standards shall be practicable and designed to meet the need for pipeline safety. In prescribing such standards, the Secretary shall consider—

Federal safety standards.

- (1) relevant available pipeline safety data;
- (2) whether such standards are appropriate for the particular type of pipeline transportation;
- (3) the reasonableness of any proposed standards; and
- (4) the extent to which such standards will contribute to public safety.

Consideration factors.

Any State agency may adopt such additional or more stringent standards for pipeline facilities and the transportation of gas not subject to the jurisdiction of the Federal Power Commission under the Natural Gas Act as are not incompatible with the Federal minimum standards, but may not adopt or continue in force after the minimum Federal safety standards referred to in this subsection become effective any such standards applicable to interstate transmission facilities.

# 49 CFR 192 - Transportation of Natural & Other Gas by Pipeline: Minimum Federal Safety Standards

- August 19, 1970 Federal regulations for:
  - Natural gas transmission pipelines
  - Natural gas distribution pipelines
  - Liqueified Natural Gas (LNG) facilities
- Prior to federal regulations, existed:
  - Many state and local regulations
  - Industry standards (ASME B31.8: Natural gas pipeline systems, NFPA 59A: LNG facilities)



# 1994 RSPA Public Meeting

- 1994: Research & Special Programs Administration (RSPA), precursor to PHMSA, held public meeting to consider regulation of underground natural gas storage.
- Industry, states, & public presented different views, and concluded that **federal regulatory action was not immediately needed.**



# Much has changed since 1994

- Incidents
- Aging facilities
- Increased public concern: Safety & Environment
- Industry standards API RP 1170 & RP 1171 developed



# Underground Natural Gas Storage Incidents

- 2001: Yaggy – Hutchison, KS
  - Gas leak travelled approx. 9 miles underground
  - 2 fatalities, fire damaged many buildings
- 2004: Moss Bluff – Liberty County, TX
  - Fire burned for 6½ days
  - Approx. 6 bcf natural gas released
- 2015: Aliso Canyon – Porter Ranch, CA



# PHMSA Steps

- Advisory Bulletin: February 5
- DOE/PHMSA Interagency Task Force: April 1
- 2016 PIPES Act mandate: June 22
- Public Workshop: July 14 in Boulder, CO
- Research Forum: October 19-20 in Phoenix, AZ
- Federal Regulations
  - Interim Final Rule (IFR)
  - Detailed regulatory review



# Advisory Bulletin ADB-2016-02

- February 5, 2016 (Federal Register 81 FR 24-6334)
- **Summary:** PHMSA is issuing this advisory bulletin to remind all owners and operators of underground storage facilities used for the storage of natural gas, as defined in 49 CFR part 192, to consider the overall integrity of the facilities to ensure the safety of the public and operating personnel and to protect the environment. Operators are reminded to review their operations to identify the potential of facility leaks and failures caused by corrosion, chemical damage, mechanical damage, or other material deficiencies in piping, tubing, casing, valves, and associated facilities and the importance of reviewing the location and operations of shut-off and isolation systems and reviewing and updating emergency plans as necessary.
- <http://www.phmsa.dot.gov/pipeline/regs/advisory-bulletin>



## DEPARTMENT OF TRANSPORTATION

### Pipeline and Hazardous Materials Safety Administration

[Docket No. PHMSA–2016–0016]

#### Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas

**AGENCY:** Pipeline and Hazardous Materials Safety Administration (PHMSA); DOT.

**ACTION:** Notice; issuance of advisory bulletin.

**SUMMARY:** PHMSA is issuing this advisory bulletin to remind all owners and operators of underground storage facilities used for the storage of natural gas, as defined in 49 CFR part 192, to consider the overall integrity of the facilities to ensure the safety of the public and operating personnel and to protect the environment. Operators are reminded to review their operations to identify the potential of facility leaks and failures caused by corrosion, chemical damage, mechanical damage, or other material deficiencies in piping, tubing, casing, valves, and associated facilities and the importance of reviewing the location and operations of shut-off and isolation systems and reviewing and updating emergency plans as necessary.

state emergency. After repeated unsuccessful attempts to contain the leak, a relief well is being drilled to plug the leaking well. The Aliso Canyon underground storage field, which can store up to 86 billion cubic feet of natural gas, has 115 storage wells, and is the second largest storage facility of its kind in the United States. The root cause of this failure is the subject of ongoing investigations and assessments and the root cause analysis is being conducted by an independent third party expert firm. PHMSA is working closely with the State of California to provide technical assistance and to support State regulatory agencies related to their response and oversight activities.

Since 2001 several accidents involving underground gas storage facilities have occurred and two of the more extensive accidents that occurred in Texas and Kansas are highlighted below. On August 19, 2004, the Market Hub Partners Moss Bluff storage facility located in Liberty County, Texas, had a well control incident and natural gas fire at Cavern #1. Over a period of six and one-half days, approximately 6 billion cubic feet of natural gas in the cavern was released and burned. The fire eventually self-extinguished, and late on August 26, 2004, installation of a blowout prevention valve was

old brine, or salt wells, in the Hutchinson, Kansas area. An explosion in downtown Hutchinson destroyed two businesses, damaged 26 other businesses, and killed two persons in a mobile home park. Approximately 143 million cubic feet of natural gas leaked from the storage field.

In this Advisory Bulletin, PHMSA recommends that all operators of underground storage facilities used for the storage of natural gas, as defined in 49 CFR parts 192, have processes, procedures, mitigation measures, periodic assessments and reassessments, and emergency plans to maintain the safety and integrity of all wells and associated storage facilities whether operating, idled, or plugged. These processes and procedures should take into consideration the age, construction, maximum operating pressures, operating and maintenance history, product, corrosion, casing and tubing condition (including chemical and mechanical damage), cement condition and depths or heights, safety valves (surface and subsurface), operation of each well, and the amount of time elapsed since the most recent assessment.

#### II. Advisory Bulletin (ADB–2016–02)

*To:* Owners and Operators of Underground Pipeline and Storage Facilities



# 2016 PIPES Act (June 22, 2016)

## Sec. 12. Underground Gas Storage Facilities:

### § 60141. Standards for underground natural gas storage facilities

(a) MINIMUM SAFETY STANDARDS.—Not later than 2 years after the date of enactment of the PIPES Act of 2016, the Secretary, in consultation with the heads of other relevant Federal agencies, shall issue minimum safety standards for underground natural gas storage facilities.



# Interim Final Rule

- Under §60102(b)(6)(c), advance notice and public procedure is not required when agency for good cause, finds that notice and public procedure are impractical, unnecessary, or contrary to public interest.
- Conducting a full notice would leave public unprotected without national safety standards for underground natural gas storage potentially for many more months.



# Interim Final Rule (IFR)

- **Interim Final Rule:** When an agency finds that it has good cause to issue a final rule without first publishing a proposed rule, it often characterizes the rule as an “interim final rule,” or “interim rule.” This type of rule becomes effective immediately upon publication. In most cases, the agency stipulates that it will alter the interim rule if warranted by public comments.
- If the agency decides not to make changes to the interim rule, it generally will publish a brief final rule in the *Federal Register* confirming that decision.

[www.federalregister.gov/uploads/2011/01/the\\_rulemaking\\_process.pdf](http://www.federalregister.gov/uploads/2011/01/the_rulemaking_process.pdf)



# Thank You

